R E M A R K S

Claim 18 was amended by inclusion of the features of claim 35.

Claim 19 was amended by inclusion of the features of claim 54.

New claim 57 is supported in the specification in the paragraph bridging pages 4 and 5 and by page 46, lines 17 to 18.

New claim 58 is supported in the specification on page 90, line 3.

Prior to addressing the prior art rejection, the presently claimed invention is discussed as follows in the context of the art.

The underwater immersion block, according to applicants' claim 18, has a porous structure on the surface and inside of the block. The porosity is defined in claim 18 as being from 10 to 70%. The porous structure of the surface results in easy adhesion of marine algae to the surface of the block, which is effective for accelerating the growth of marine algae and for their ready elution to seawater. It is thus possible to effectively promote the growth of marine algae, as compared with cases in which a massive slag is used as a block for underwater

immersion without any processing, as well as to concrete fishing banks comprising an aggregate made of slag.

The cited art does not disclose or suggest a block prepared from a granular iron and steel making slag mixture having a porosity of 10 to 70%. Therefore, it is respectfully submitted that the present claim 18 is clearly novel and unobvious, in view of the cited references.

As recited in applicants' present claim 19, the packed bed comprising a granular iron and steel making slag mixture has a bulk specific gravity/true specific gravity ratio of 0.3 to 0.9. If the bulk specific gravity/true specific gravity ratio exceeds 0.9, the permeability of the packed bed is deteriorated and the carbonation treatment cannot be sufficiently carried out. If the bulk specific gravity/true specific gravity ratio is under 0.3, the contact among the slag granules decreases and the strength of the produced block decreases.

None of the cited art references teach or disclose a method of producing a block wherein the packed bed has a bulk specific gravity/true specific gravity ratio of 0.3 to 0.9. Therefore, it is respectfully submitted that the present claim 19 is novel and is also not rendered obvious by the cited prior art.

The presently claimed invention serves to countermeasure some of the worldwide environmental problems. The present invention serves to clean the sea with respect of promoting photosynthesis (the production by a green plant of special substances, caused by the action of sunlight on chlorophyll).

The position was taken in the Office Action that cement blocks for use in artificial reefs have been known in the art. However, the present invention is directed to a slag block, not a concrete block.

The position was taken in the Office Action that the Knopf et al. patents teach carbonated cementitious materials for building artificial reefs. However, as discussed herein, applicants' claimed invention is directed to a slag block.

Until now, various methods have been tried for making use of slag produced in the steel-making process as a seawater immersion block or a river-water immersion block for planting algae and/or gathering fish on the rocky places. However, unfortunately, such a massive slag has a disadvantage, which means, it has almost the same effect as a natural block, and thus it is not effective to accelerate the growth of sea algae.

Applicants discovered that to make effective use of slag from the steel-making process for planting algae, a determined size to some degree was needed. That is why broken slag cannot be used. On the contrary, to recover the metal from the slag, the slag should be pulverized into a small size to some degree.

Concerning another problem regarding making use of an immersion block, the calcium content in the slag is dissolved into the water and, then, there arises the possibility of raising the pH value in the seawater or in the river-water into which the immersion block is placed. Furthermore, slag from the steel-making process contains a substantial amount of metal. So, if massive slag is immersed into the water directly, the grain iron is oxidized and there is a possibility to invite a shortage of oxygen. Not only by the reason of the immersion block-size, but also by the reason of the shortage of oxygen, the metal content should be sufficiently removed.

Concerning a concrete block, by the reason of a high pH value, whose value is normally from 12 to 12.5, it might cause difficulty that such a high pH value increases the pH in the river, and such a higher pH value delays the growth of the algae.

A conventional fish way has no obstacle for fish to move, as far as there exists no problem concerning the flow rate of water, water bottom obliquity or steps. However, a fish way made with concrete has a smooth surface at the bottom, so that water creatures such as algae cannot live so easily. In summary, such a smooth surface fish way is not preferable for the living creatures in river water, especially for their movement on the riverbed. From this point of view, the present invention provides an advantageous result.

The following portions of the present specification serve to highlight the advantages of the present invention.

Page 51, lines 11 to 20, and especially the following lines 11 to 13 of page 51 of the specification:

> "Ordinarily, the slag passing the metal removing treatment has a grain size of mm-order or smaller (for example, 5 mm or lower)."

Page 57, line 18 to page 58, line 16, and especially the following lines 8 to 9 on page 58 of the specification:

> "From the viewpoint of the dissolution in the seawater and the breeding of marine algae, the metallic iron or the metal containing iron material among the iron sources are particularly preferable." (emphasis provided)

Page 72, lines 4 to 8 of the specification:

> "If the carbon dioxide or the gas which contains the carbon dioxide is once blown into the water to saturate H_2O, followed by blowing it into the piled mountain or packed bed, the slag is prevented from being dried to accelerate the carbonation reaction." (emphasis provided)

Page 81, lines 12 to 17:

> "The embodiment is concerned with immersion blocks in the rivers of a main raw material being a slag generated in the iron-steel making process, and is characterized by consolidating the slag with a binder of $CaCO_3$ and $MgCO_3$ produced by a carbonation reaction, and making the slag massive." (emphasis provided)

The paragraph bridging pages 84 and 85 of the specification and particularly the following from page 84, line 3 from the bottom to page 85, line 3:

"This is why the iron content contained in the slag in a proper amount is dissolved in river water, so that the iron content is supplied as a nutrient salt in river water, and this usefully works for rearing marine algae. Thus, the iron content in slag is appropriately 3 wt% or more." (emphasis provided)

Page 88, lines 17 to 20 of the specification:

"The embodiment (sizes or shapes) for using the river immersion blocks is optional, and the sizes may be selected in response to usage from orders of 1000 mm or larger to orders of several ten mm."

Page 90, lines 5 to 12:

"The massive slag obtained by carbonation-solidifying the grain like slag and/or the rough grain like slag have porous properties as a whole (surface and interior), so that such as algae are easily attach the surfaces of blocks. Besides, since the interior of block is also porous, elements contained in blocks useful to growing and accelerating of the algae are easily dissolved, and the growth of algae is good." (emphasis provided)

An important object of the present invention is to provide a water immersion block. The immersion block is excellent for rearing algae and breeding fish and shellfish without heightening the pH in seawater or river water. The present invention also

provides a method for making the same, and a further method for building an algae planting place using a water immersion block.

Page 46, lines 17 to 19 of the specification describes a specific method for preparing the water immersion block:

> "Ordinarily, grain sizes of the slag having passed the metal recovering process are at cm-order or smaller (for example, 5 cm or smaller)". (emphasis provided)

Page 51, lines 14 to 20 of the specification:

> "Therefore, for the sea water-immersion blocks of the invention to be applied in the sea area involved with the problems concerning the shortage of oxygen in the sea water owing to oxidation of the iron content in slag or the excessive supply of iron content in the sea water, the raw material is the slag shaped in grain and/or rough grain having passed the metal recovering treatment."

Page 51, lines 21 to 24 of the specification:

> "In the metal removing treatment, metals in slags are desirably removed as much as possible, except inevitably removable metals. Normally, the iron content (metal) in slag is preferably less than 3wt%." (emphasis provided)

Page 60, lines 3 to 5 of the specification:

"The block material of the present embodiment is relatively porous, thereby bringing about the above mentioned effects. The percentage of voids is not especially limited, however, around 10 to 70% is preferable."

Another technologically desirable specific feature of the present invention is with respect to the maximum compression strength. Applicants discovered to adjust the water content in mixture to be a value at which a compression strength of a massive substance is at a maximum after the carbonation treatment. Concerning how to adjust the water content, see page 71, line 14 to page 73, line 5 of the specification.

Page 73, lines 13 to 19 of the specification:

"After completing the carbonation solidification, the piled mountain or the charged layer are broken and pulverized into the required sizes by heavy machinery, and cut out into massive block materials to be immersed in the sea. Ordinarily the blocks are cut into the sizes of 80 to 1500 mm. By this pulverization when cutting out, the blocks have fractures of irregularities for easily catching marine algae" (emphasis added)

As we discussed above, the present invention has several advanced technological features, compared with the cited prior arts.

Claims 18, 19 and 21 to 56 were rejected under 35 USC 103 as being unpatentable over Knopf et al. (USP 6,387,174; USP 6,264,736) alone or in view of Jones et al. (USP 5,113,792), Warren et al. (USP 5,803,660), Mostkoff (USP 5,908,265), Barnes (USP 6,431,792), "The Miroz System for the Construction of Artificial Coral Reefs Using Coral Fragments" (no date supplied by the Examiner) or Jim Hardie, "Private Artificial Reef May Be in Your Fishing Future" (March 22, 1998) for the reasons set forth on pages 2 and 3 of the Office Action.

It was admitted in the Office Action that Knopf et al. do not teach for use underwater.

Knopf et al. do not teach or suggest the aforementioned advantageous features of the present invention which relate to the improvement of the industrial worldwide environmental technology. Knopf et al. merely disclose carbonating large cement structures, by forming and hardening cement in a mold

under high carbon dioxide density, such as supercritical or near-supercritical conditions.

The present invention provides several specific features that are not taught or suggested by Knopf et al., such as the porous structure, the bulk specific gravity/true specific gravity and other technical specific features that provide desirable results, for example, breeding marine algae to solve the shortage of oxygen in the sea water.

In Jones et al., an artificial reef module for creating a feeding and shelter habitat for fish is disclosed. However, this module merely includes a column of vertically or horizontally arranged sheets of corrugated material. Jones et al. do not teach or suggest such a specific module as the present invention. Jones et al. disclose anchoring means but, from this point of view, Jones et al. is substantially different from the present invention. The sheets of the Jones et al. module are formed of polyvinyl chloride, which is also substantially different from the present invention.

In Warren et al., only a variety of shapes are disclosed. Furthermore, there is no prospective view in Warren et al. to

show how to use the blocks.

In The Miroz System for the Construction of African Coral Reefs Using Coral Fragments, it is said that someone has developed a system for building artificial reefs using coral fragments of various sizes. It is also said that the initial process involves rehabilitation under laboratory conditions for the fragments in order to minimize stress, permit recovery and promote initial growth. However, from an advanced technological point of view, it goes without saying that such an article is merely a first step of the idea, and there is no teaching or suggestion concerning specific apparatus and methods for breeding algae.

In comparison with Hardie, Private Artificial Reef May be in Your Fishing Future, the present invention discloses a variety of technical specific features concerning an apparatus and a method. In contrast thereto, Hardie discloses only a "Reel Ball" made of concrete.

Mostkoff concern only an artificial reef module made of pyramid shaped molds.

Barnes relates only to an artificial reef structure, including square blocks having recesses.

It is therefore respectfully submitted that applicants' claimed invention is not rendered obvious over the references, either singly or combined in the manner relied upon in the Office Action in view of the many distinctions discussed hereinabove. It is furthermore submitted that there are no teachings in the references to combine them in the manner relied upon in the Office Action.

Reconsideration is requested. Allowance is solicited.

If the Examiner has any comments, questions, objections or recommendations, the Examiner is invited to telephone the undersigned at the telephone number given below for prompt action.

Respectfully submitted,

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